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ABSTRACT

The final technical report is presented on the establishment and operation of an Exchange of Information among universities, corporations and government agencies concerned with the use of the computer as an aid to the instructional process. Four modes of information dissemination are described. A monthly dissemination of information on cards comprises the first mode; data distributed includes computer-assisted instruction (CAI) research abstracts, CAI program specifications, computer-managed instruction (CMI) research abstracts, and CAI facility descriptions. Descriptions of the seven conferences making up the second mode include special topics covered: CAI languages, CAI in technical education, CAI in health professions, simulation in CAI, and instructional strategies in CAI. The third mode consisted of a three-week workshop which is considered briefly in the report. The final mode, annual integration of the data into literature surveys, is also examined. Methods of data collection (site visits and questionnaires) and classification (construction of CAI and CMI thesauri) are included. (Author/SP)

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COMPUTER-ASSISTED INSTRUCTION

INFORMATION EXCHANGE

Final Technical Report
for the period
1 February 1965 - 31 December 1969

Project NR 154 254
of the
Personnel and Training Research Programs Office
Office of Naval Research
Contract N00014-68-C-0236
(formerly Nonr-4757(00))

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ENTELEK Incorporated
Newburyport, Massachusetts 01950
(617) 465-3000

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COMPUTER-ASSISTED INSTRUCTION

INFORMATION EXCHANGE

Contract Nonr-4757(00)
Contract N00014-68-C-0236

FINAL TECHNICAL REPORT
1 February 1965 - 31 December 1969

COMPUTER-ASSISTED INSTRUCTION

INFORMATION EXCHANGE

Final Technical Report
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Contract Nonr 4757(00)
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(617) 465-3000

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13. ABSTRACT

This is the final technical report for contracts Nonr 4757(00) and N00014-68-C-0236 between the Office of Naval Research and ENTELEK Incorporated, whereby ENTELEK established and operated an Exchange of Information among universities, corporations and government agencies concerned with the use of the computer as an aid to the instructional process. Four modes of information exchange are described: (1) a monthly dissemination of information on cards, (2) conferences, (3) a workshop and (4) an annual integration of the data.

Seven conferences were held on special topics such as Computer-Assisted Instruction (CAI) Languages, CAI in Technical Education, CAI in the Health Professions, Simulation in CAI and Instructional Strategies in CAI. One three-week workshop was conducted in 1966 at the Naval War College. The core of the exchange, however, is the monthly distribution of data on cards. Four kinds of data are distributed: CAI research abstracts, CAI program specifications, CMI research abstracts, and CAI facility descriptions. About once a year the information in the data base is reevaluated and integrated in a Survey of the Literature. Three editions of the Survey were prepared during the term of the contract.

The CAI/CMI Information Exchange continues to function on a self-sustaining basis. At the termination of the contract 250 institutions were participating.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
computer						
instruction						
information						
conference						
workshop						
thesaurus						

Abstract

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I. INTRODUCTION

In 1965, to increase the flow of information in the fast-growing field of computer-assisted instruction (CAI), the Personnel and Training Branch of the Office of Naval Research initiated an exchange of information among institutions actively practicing CAI or conducting research in the field. To implement the CAI Information Exchange, ONR made contract Nonr 4757(00) with ENTELEK Incorporated. This contract was superceded in 1968 by contract N00014-68-C-0236.

At the outset, participants in the Exchange were primarily universities and other organizations under contract to ONR to do research in CAI, plus agencies of the federal government that had a need to keep abreast of the new technology. The Office of Naval Research was one of the first agencies to provide support for research in CAI. In 1965 the Personnel and Training Branch and the Information Systems Branch of ONR had CAI-related contracts with the University of Illinois, Stanford, MIT, Bolt Beranek & Newman, System Development Corporation and several other activities.

When the Exchange was established it was clear that there would be a rapid growth in the amount of CAI research and in the number of people who would want to participate in the Exchange, and that the Office of Naval Research could not justify full support of the Exchange indefinitely. Consequently, beginning in 1967, the level of ONR support was gradually reduced and the participants were asked to shoulder part of the cost, particularly the cost associated with the dissemination, as opposed to the

collection of data. At the termination of the contract in December 1969, the Exchange was self-sustaining with 250 institutions participating. The list of participants at that date is given in Appendix A.

Computer-assisted instruction has been defined by Dr. Glenn Bryan as any situation in which a student and a computer are in direct interaction with the objective of bringing about desirable behavior change, i.e., learning, in the student. A complementary use of the computer as an aid to the teacher in the process of instruction emerged in about 1968 and has come to be known as computer-managed instruction (CMI). In CMI it is the instructor who is the loop with the computer. The instructor inputs to the computer aptitude and achievement data for individual students and receives individual prescriptions for instruction.

CMI makes it easier to manage CAI and other techniques of individualized instruction, including programmed instruction. In 1969, the CAI Information Exchange was broadened to include CMI.

Dr. Albert E. Hickey was the principal investigator.

II. DESCRIPTION OF THE SERVICE

In the first year of the contract, ENTELEK project personnel met monthly with Dr. Bryan to establish the Exchange procedure. Two kinds of service emerged: 1. an exchange of information on cards and 2. conferences.

A. The Card System

1. The mainspring of the ENTELEK CAI/CMI Information Exchange is the monthly distribution of data on cards bound in book form. Each monthly book has about 190 pages of data. The user may browse through the book and then shelve it, or he may remove the cards to create a comprehensive file on CAI and CMI, as described below. Some 35 sets of data have been distributed since the Exchange began.

2. There are four kinds of data in each monthly volume of cards: (1) abstracts of the CAI literature, (2) specifications of CAI programs, (3) abstracts of the CMI literature, and (4) descriptions of CAI/CMI facilities. Each kind of data is printed on color-coded cards to permit quick classification. A sample of each type of card is shown in Appendix B.

3. A steel file cabinet complete with 100 dividers, each printed with a caption, is provided to permit easy filing of the data cards. The result is an integrated, up-to-date library tool. The organization of the file is shown in Figure 1.

4. When the user first joins the Exchange, he receives microfiche containing all the CAI/CMI data distributed since 1965. The fiche are accompanied by complete indexes to permit retrieval of data by subject, author, etc.

B. The Survey of the Literature

Since mere accumulation of data is no answer to the explosion of technical information, ENTELEK publishes an annual survey and synthesis of the data that have passed through the Exchange from its inception. Research findings are interrelated, trends identified, and obsolete information deleted.

Three editions of the Survey were published during the term of the contract. Under the phasing-out agreement the third edition was published by ENTELEK in October 1968 at no cost to the contract. The first three editions were edited by Dr. Hickey. A fourth edition is currently being prepared by Cornelius Butler of Stanford University.

C. Conferences

During the contract years of 1965, 1966, 1967 and 1968 seven conferences on CAI were sponsored by ONR under the ENTELEK contract. Three of the meetings were conducted at CAI research centers (Stanford, Illinois and the System Development Corporation) to give more exposure to the work of those projects. Four of the meetings were devoted to specific topics in CAI. A brief description of each conference follows:

1. Stanford University

2. University of Illinois

3. CAI Languages (Cambridge, Mass.)

4. CAI in Technical Education (Pennsylvania State University, April 1967)

5. Simulation in CAI (University of Texas, January 1968)

6. CAI in the Health Profession (Harvard University, February 1968)

7. Instructional Strategies Appropriate to CAI (Washington D. C., October 1968)

From 25 to 40 members of the CAI interest group attended each meeting. ENTELEK published the proceedings of each. In the final year of the contract the topical meetings were superceded by four regional meetings conducted by ENTELEK at no cost to the contract under the "phasing out" policy. The proceedings of these meetings were also published by ENTELEK. The second round of regional meetings was recently held and the proceedings are now in preparation.

Since 1968 sponsorship of national meetings on CAI has been assumed by various professional and user groups, e. g., the National Security Industrial Association; ADIS, the IBM educational user's group; et al.

D. CAI Workshop at the Naval War College

From its vantage point in the Office of Naval Research, the Personnel and Training Branch felt that the summer of 1966 was the opportune time to demonstrate CAI to Navy educators and to give selected instructors the opportunity to learn to apply the new CAI technology to their teaching

objectives. To this end, ONR organized three CAI workshops for the summer of 1966.

1. At Project PLATO, University of Illinois, for Naval Academy faculty.
2. At the Naval Academy, Annapolis, for Naval Academy faculty.
3. At the Naval War College, Newport, for the faculties of Navy schools in the Newport area.

ENTELEK conducted the CAI workshop at the Naval War College, a three-week program extending from July 11 to 28. The objectives of the Newport workshop were to review the state of the computer-assisted instruction art in terms of its application to the U. S. Navy, with special emphasis on the activities at Newport, and to provide guided practice in writing CAI programs to a selected group of Naval officers on the Newport base.

Representatives were designated by the War College, Officer Candidate School, Destroyer School, Correspondence School, and Naval Supply Depot. The program gave equal time to (1) "hands-on" demonstration and practice with time-shared computer utilities and (2) presentations on man-computer interaction by guest lecturers.

Connections were established with remote computers at Bolt Beranek and Newman, General Electric, and IBM Yorktown. Interaction was also established with the concurrent workshop at the Naval Academy through the G. E. computer.

The staff and guest lecturers for the workshop included Professors Ward Edwards (University of Michigan), Philip Merrifield (Kent State), John Poppe (ICAF) and Harold Guezkow (Northwestern). Also Dr. John Summers (MITRE) and Mr. Wallace Feurzeig (Bolt Beranek and Newman).

Drs. Hickey and Gordon M. Becker conducted the workshop for ENTELEK.

III. DATA COLLECTION AND CLASSIFICATION

A. Site Visits

A primary objective of the Exchange has been to achieve a short lag in the distribution of CAI data. Consequently, ENTELEK adopted an active rather than a passive approach to data collection. From 1965 through 1969 ENTELEK personnel visited virtually every major CAI facility in the U.S. and attended the principal conferences at which reports of CAI research were given. Over 60 such visits were made in all. A list of sites visited is given in Appendix C.

B. Questionnaires

To capture data for the Exchange ENTELEK formulated a questionnaire for each kind of data:

(1) CAI Research Abstract

(2) CAI Program Specification

(3) CMI Research Abstract

(4) CAI Facility Descriptions

A copy of each appears in Appendix D.

C. CAI and CMI Thesauri

To classify the data on CAI, and later on CMI, it was necessary to build two thesauri, since the two subjects had not been covered in such detail before. The same thesauri serve to organize the contents of CAI: A Survey of the Literature. They appear in Appendix E.

ENTELEK CAI CARD FILE ARRANGEMENT

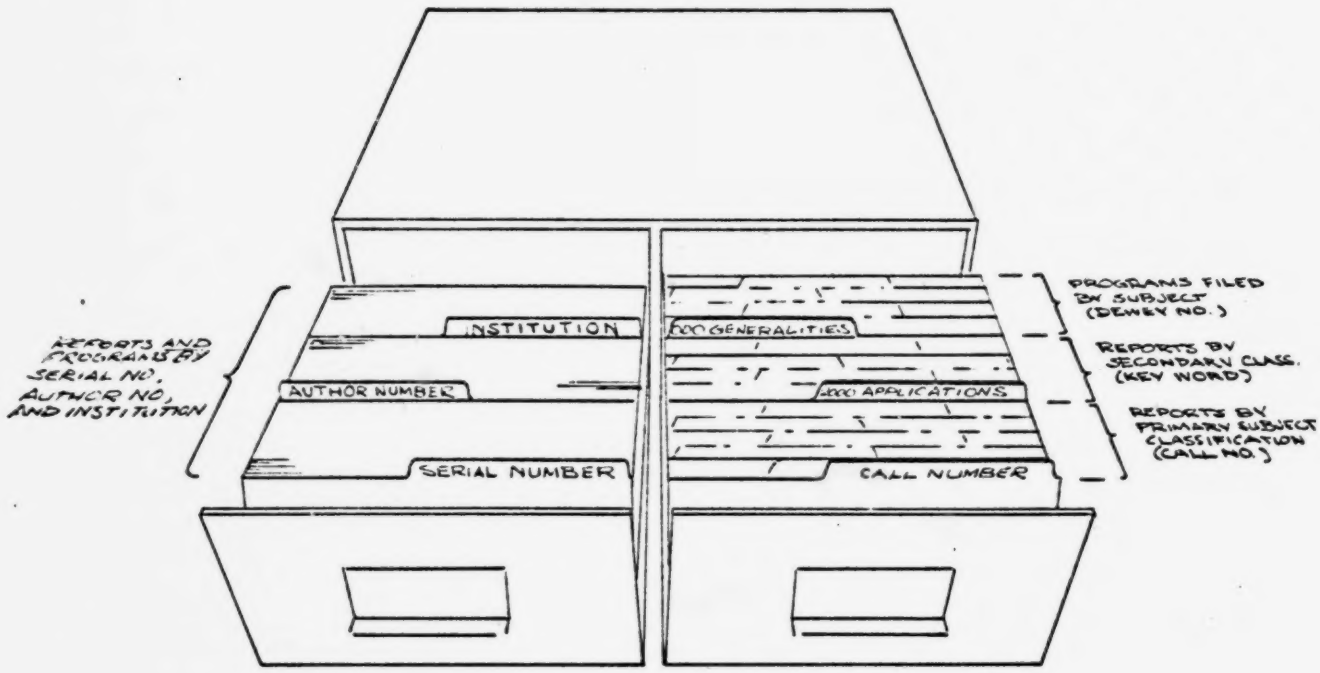
REPORTS AND PROGRAMS BY SERIAL NO., AUTHOR NO., AND INSTITUTION
INSTITUTION
AUTHOR NUMBER
SERIAL NUMBER
000 GENERALITIES
000 APPLICATIONS
CALL NUMBER
PROGRAMS FILED BY SUBJECT (DEWEY NO.)
REPORTS BY SECONDARY CLASS. (KEY WORD)
REPORTS BY PRIMARY SUBJECT CLASSIFICATION (CALL NO.)

Figure 1.

APPENDIX A.

Name	Institution or Organization
Dr. J. Annett	Hull University, England
Prof. Richard C. Atkinson	Stanford University
Dr. Richard Balomenos	National Science Foundation
Richard Barry	Off. of Info. Sys. Planning and Development
Mr. Roger Berkshire	U. S. Naval School of Aviation Medicine
Dr. D. L. Bitzer	PLATO, Univ. of Illinois
Dr. A. deBrisson	Centre d'Etudes et de Recherches, France
Prof. C. Victor Bunderson	Univ. of Texas
Sqn Ldr. Ivor K. Davies	Royal Air Force
Dr. Barrett Denton	Behavioral Sc. Lab., Wright-Patterson AFB
Directorate of Individual Training	Off. of Asst. Secy. of Defense (Manpower)
Mr. James S. Duva	Naval Training Device Center
E. Elliott, Esq.	Ministry of Defense (Navy), England
Dr. Gerald Engel	U.S. Naval Weapons Lab.
Dr. Wallace Feurzeig	Bolt Beranek and Newman
Dr. Victor Fields	Office of Naval Research
Dr. John D. Ford	U. S. Naval Personnel Research Activity
Capt. J. E. Forrest	USN, Ind. College of the Armed Forces
Dr. Eugene E. Gloye	Office of Naval Research
Dr. Duncan Hansen	Florida State University
Mr. Larry G. Harding	Naval Air Station
Mr. Anthony M. Hodgson	Inst. for Comp. Stdy. of Hist., Phil. & Sc., ENG.
M. O. Houziaux	Inst. de Mathematique, Belgium
Capt. Geoffrey Huggett	Greystoke, England
Mr. Max Jerman	Stanford University
Dr. Felix F. Kopstein	HumRRO, G. Washington Univ.
Mrs. Betta H. Kriner	Penn State Univ.
Dr. Herbert F. LaGrone	Texas Christian Univ.
F. H. Lakin	Defence Operation Anal. Establishment, ENG.
Dr. J. C. R. Licklider	M. I. T.
Dr. Sylvia R. Mayer	HQ ESD (ESVPT), Hanscom Field
Major John R. Parker	U. S. Military Academy
Mr. Adrian Parmeter	Office of Education
Gordon Pask, Esq.	System Research Ltd., England
Capt. Edward M. Porter, Jr.	Naval War College
Dr. Paul Quinn	U. S. Naval Academy
Mr. William W. Ramage	Univ. of Pittsburgh LRDC
Dr. Joseph W. Rigney	Univ. of Southern California, L. A.
Dr. Ray Roberts	Naval Pers. Prog. Support Activity
Dr. Harry Silberman	System Development Corp.
Dr. H. Wallace Sinaiko	Office of Naval Research Branch Office
Dr. Lawrence M. Stolurow	Harvard Computing Center
Mr. Harley Tillitt	U. S. Naval Ordnance Weapons Center
Mr. Earl K. Wallace	USAFHQ (AFP-TRD)
Dr. Richard L. Wing	BOCES
Dr. Karl L. Zinn	Univ. of Michigan - CRLT

Name	Institution or Organization
Department of Education	Michigan State University
D'Anne Boedeker	McREL (Mid-continent Regional Educ. Lab.)
Dr. Louis A. Formica	Mineola Public Schools
Mr. John R. Crocker	Minnesota School Districts
Special Education Dept.	University of Minnesota
Department of Sociology	The University of Minnesota
Mr. William L. Stucker	Univ. of Missouri Regional Medical Program
--	The Mitre Corporation
--	Montgomery County Public Schools
Product Specifications Dept.	The National Cash Register Co.
Chief, Training Unit	Natl. Communicable Disease Center
John Duke	Natl. Council for Educational Tech., England
Training Supervisor	NATTC, Naval Air Station
Technical Reference Library	Naval Medical Research Institute
Washington Navy Yard	(Navy) Personnel Research Laboratory
David H. Brand	N.E. Medical Center Hospitals
Speech Dept.	New Mexico State University
Mr. Hugh McDougall	Board of Education - City of New York
Prof. A. Dorman	New York City Community College
Dr. Cyril H. Price	New York City Community College
Dr. F. Brooks Sanders	State University of New York
Robert C. Rowe	State Univ. of New York at Albany
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Order Librarian	State University College (Potsdam, N.Y.)
Computing Center	N.Y. State Univ. Downstate Medical Center
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Prof. A. G. LoRe	Univ. of North Carolina For. Lang. Labs.
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--	Northern Virginia Community College
--	Northwest Regional Educational Lab
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Newman Walker	Paducah Board of Education
Dr. Sylvia Charp	Phila. Board of Education
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Mr. David L. Hackett, Pres.	Policy Management Systems Inc.
M. William Lee	Quebec Ministre de l'Education
Computer Center	Queens College (CUNY), Bd. of Higher Educ.
Mr. Jerome D. Carp	Radio Corporation of America

Name	Institution or Organization
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(Air Force)	Maxwell Air Force Base, Info. Science
(" ") W. E. Hurley	Wright-Patterson AFB Schl. of Logistics
(" ") Lt. Col. D. Ford	Wright-Patterson AFB (AFIT-SLF)
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Dr. S. Hunka	University of Alberta
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Mr. G. J. Stumpfl, Jr., Pub. Relations	Am. Telephone & Telegraph Co.
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Systems & Electronics Laboratory	Battelle Memorial Institute
James S. Tomes, A-V	Bell & Howell Company
John G. Tuttle	Bell Telephone Labs
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W. Bucchino	AMI
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Rec'g. Dept. Parnassus at Arguello	University of California-S. F. Medical Ctr.
School of Education,	The Catholic University of America
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*Ctr. for the Study of Prog. Lrng.	University of Minnesota
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Receiving Dept.	General Motors Institute
Regional Curriculum Project	Georgia Department of Education
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Mr. T. S. Gemmell	Information Science Institute
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W. H. Niehoff	IBM, Endicott, New York
Mrs. R. J. Tripicco	IBM, AMD Dept., Endicott, N. Y.
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Dr. John W. Robson	University of Maryland, Comm. on Coll. Phys.
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Org. 3132, R. F. Utter	Sandia Corporation
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APPENDIX B.

Sample of Data Cards

ENTELEK | CAI Research Abstract

S000
S927

68-1030/31

Strum, Irene

Use of CAI in New York State Public Schools

New York State
3300

El-hi
2735

Summary report, Board of Cooperative Educational Services #1 (BOCES), Yorktown Heights, N. Y.; October 1968.

The purpose of this investigation was to study in depth the use of computer-assisted instruction (CAI) in New York State public school districts. As a follow-up to a study by the State Education Department, questionnaires were sent to eighty chief school administrators who had indicated that they were engaged in CAI. On the basis of 39 returns, it was found that eight schools were actually engaged in CAI.
Craig School, Schenectady - teaches math, language arts, and social studies for grades 1 to 5; programs written by teachers in Basic and Fortran. GE computer used belonging to GE Research and Development Lab; one GE terminal. Computer operations financed through GE Lab.
Half Hollow Hills High School, Huntington - teaches science for 10-12 grade; programs written by professors at Brooklyn Polytechnic Institute

(over)

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ENTELEK | CAI Research Abstract

1300
S582

M68-0201/30

Silberman, Harry F. (System Development Corp.)

Design Objectives of the Instructional Management System

Paper presented at AERA annual meeting, February 8, 1968.

To help the teacher make more accurate decisions about the daily presentation of lessons, an Instructional Management System, called IMS, is being developed by the System Development Corporation and the Southwest Regional Laboratory. IMS is currently operating in two elementary schools in the Los Angeles City School District. Its purpose is to provide diagnostic and prescriptive information to the teacher to assist her in making such instructional decisions as how fast to pace instructional units, when to re-group students, and how to modify the sequence of instruction. The testing and information system of the Instructional Management System is described briefly.

Three design objectives guided the development of IMS:
1) An evolutionary approach to implementation

(over)

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330
R522

P69-0206/28

1. MAC03
1a. Elementary Keynesian macroeconomic models (4)
2. Richardson, David A.
3. College students in introductory economics course
4. No prerequisites
5. User time varies with level of sophistication from 1/2 to 1 hour.
6. Socratic and tutorial
7. FORTRAN IV
8. IBM 1802 (16K core storage and 16 bit words; core requirement is 3500 words)
9. Teletypewriters
10. Handout stating basic model equations and definitions
11. Reports available from Director of Beloit College Computing Center
12. Beloit College Computing Center, Beloit, Wisconsin
13. Available upon request
14. See also MIC01 (P69-0205), MAC05(P69-0207) and Facility Description F69-0203
15. Specifications submitted in February 1969
16. National Science Foundation (COSIP grant) and Beloit College

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F69-1202/28

1. Air Force Institute of Technology, School of Systems and Logistics, Computer Support Department
2. Wright-Patterson Air Force Base, Ohio 45433
3. Director: Captain D. Veasey
4. Key personnel: 1LT David B. Lovenian
5. Facility is operational
6. Computer is general purpose
7. Central Processor: IBM 1620 II
8. CPU is at facility
9. Processor Controllers: --
10. Storage: 2 disks (2 million digits each)
11. On-line I/O:
    a. Terminals: Teletypes (Model 35)
    b. Auxiliary visual displays: --
    c. Audio I/O: --
    d. Other: --
12. Data-processing I/O:
    a. Card-reader punch: IBM 1622
    b. Paper tape: --
    c. Magnetic tape: --

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APPENDIX C

SITE VISITS AND CONFERENCES ATTENDED

CAI Site	Man Days
System Development Corporation	5
Stanford University	2
Dartmouth College	1
Providence College	2
Brown University	1
Philco-Philadelphia	1
USNA	1
U/Pitt LRDC	1
Bolt, Beranek and Newman	3
Harvard University	3
Pennsylvania State University	5
Dartmouth College	2
Harvard University	10
U.S. Navy Training Device Center	1
U.S. Naval Academy	1
University of Pittsburgh	2
American Educational Research Assoc. (Annual Meeting)	4
Association for Educational Data Systems (Workshop)	1
School District of Philadelphia	2
U.S. Navy Medical School	1
Office of Under Secretary of Defense (Man)	1
IBM Instructional Systems Mktg. Dept.	1
American Management Association Conference on Educational Technology	6
Project ARISTOTLE Symposium	2
ONR Conference, Washington, D.C.	6
Dartmouth College	1
Assoc. for Programmed Learning (UK)	4
Nat'l. Council Teachers of Mathematics	8
Am. Soc. for Training and Develop.	4
Am. Assoc. of School Admin.	2
Am. Educ. Research Assoc. Annual Meeting	
U/Pitt LRDC	
U/Mass. Educ. Adm. Conference	
Lehigh University, Psychology Department	
Nat'l. Council Teachers of Mathematics	
Assoc. for Educ. Data Systems Annual Conf.	
Spring Joint Computer Conference	
Am. Management Assoc. 5th Education and Training Equipment Exposition	

ENTELEK CAI/CMI Regional Conferences

Chicago, February 4, 1969
Los Angeles, February 1969
Chicago, October 1969
New York, October 1969
Washington, D. C., November 1969

APPENDIX D.

Data Collection Questionnaires

ENTELEK CMI RESEARCH ABSTRACT

Entelek call no. _____

Entelek serial no. _____

Cutter Sanborn classification no. _____

1. Author(s) _____

2. Author's Affiliation (if not that of the originating activity) _____

3. Title _____

4. Originating activity of corporate author (include the subordinate unit of the organization) _____

5. Type of document (e.g. final report, interim report, thesis, etc.) _____

6. Report date (day, month, year) _____

7. Report no. _____ 8. No. of pages _____ 9. No. of references ____

10. Sponsoring agency and contract or grant no. (if any) _____

11. Abstract _____

(Please continue on other side if necessary.)

12. Key words or retrieval terms (up to 7) _____

The abstract (item 11 above) should not be over 200 words in length. Please emphasize facts and conclusions. We shall supply the Cutter (author) number, call number and ENTELEK serial number.

ENTELEK CAI RESEARCH ABSTRACT

Entelek call no. _____

Entelek serial no. _____

Cutter Sanborn
classification no. _____

1. Author(s) _____

2. Author's Affiliation (if not that of the originating activity) _____

3. Title _____

4. Originating activity ot corporate author (include the subordinate unit of the organization) _____

5. Type of Document (e.g. final report, interim report, thesis, etc.) _____

6. Report date (day, month, year) _____

7. Report no. _____ 8. No. of pages _____ 9. No. of references _____

10. Sponsoring agency and contract or grant no. (if any) _____

11. Abstract _____

(Please continue on other side if necessary.)

12. Key words or retrieval terms (up to 7) _____

The abstract (item 11 above) should not be over 200 words in length. Please emphasize facts and conclusions. We shall supply the Cutter (author) number, call number and ENTELEK serial number.

ENTELEK CAI PROGRAM SPECIFICATIONS

Dewey Decimal classification no. _____

Entelek Serial no. _____

Cutter Sanborn classification no. _____

1. Program name _____
1a. Subject matter _____
2. Author(s) _____
_____
3. Target population _____
_____
4. Curriculum relationships (e.g. prerequisites) _____
_____
5. Length of program _____
6. Instructional logic (e.g. tutorial, socratic) _____
7. Instructional language (e.g. COURSEWRITER) and/or compiler _____
_____
8. Computer(s) (incl. storage requirements) _____
_____
9. I/O Devices (e.g. terminals) _____
_____
10. Auxiliary equipment or materials (e.g., notebooks, projectors) _____
_____
11. Performance results (e.g. published reports) _____
_____
12. Installations _____
13. Availability _____
14. See also ENTELEK Program Abstracts _____
_____
15. Source documents _____
_____
16. Sponsoring Agency _____
_____

ENTELEK CAI FACILITY DESCRIPTION

1. Official name of the CAI facility: _____
2. Address: (Street) _____
   (City) _____ (State) _____ (Zip) _____
3. Director: _____
4. Names and titles of additional key personnel: _____
5. Facility is operational _____ or in development _____
6. Indicate whether general purpose _____ or special purpose _____ computer
7. *Central Processor: _____
8. CPU is at facility _____ or is remote _____
9. *Processor Controllers (incl. number): _____
10. *Storage (disk, tape, etc.; incl. capac.): _____
11. *On-line I/O:
    a. Terminals (including number of each kind) _____
    b. Auxiliary visual displays _____
    c. Audio I/O _____
    d. Other _____
12. *Data-processing I/O:
    a. Card-reader punch _____
    b. Paper tape _____
    c. Magnetic tape _____
    d. Line printer _____
    e. Plotter _____
    f. Other _____
13. Programming Systems and Languages:
    a. Assembler _____
    b. Compiler _____

(Over)

APPENDIX E.

CAI and CMI Thesauri

ENTELEK CAI/CMI INFORMATION EXCHANGE

CAI THESAURUS

1000-1999 GENERAL INFORMATION

1000 General

- 1010 Literature review or surveys
- 1020 Bibliographies
- 1030 Source documents for CAI instructional programs

2000-2999 APPLICATIONS OF CAI

2000 Instructional programs by subject matter - General

- 2100 Mathematics and Statistics - General
  - 2101 Algebra
  - 2102 Arithmetic, binary
  - 2103 Algebraic proof
  - 2104 Number squaring, cubing, etc.
  - 2105 Statistics, descriptive
  - 2106 Statistics, inferential
  - 2107 Arithmetic, elementary school
- 2120 History - General
  - 2121 American history
- 2140 Languages - General
  - 2141 English
  - 2142 Logic: Syllogisms
  - 2143 Spanish
  - 2144 German
  - 2145 Chinese
- 2160 Science - General
  - 2161 Medicine
  - 2162 Physics
  - 2163 Science, elementary
  - 2164 Genetics
- 2180 Economics - General & Social Sciences
  - 2181 Economics games
- 2220 Engineering - General
  - 2221 Structures
  - 2222 Dynamic systems
  - 2223 Electrical
- 2240 Computer technology - General
  - 2241 Computer approaches to engineering problems
  - 2242 Computer programming
  - 2243 Computer use
- 2260 Games - General
  - 2261 Bridge
  - 2262 Roulette
  - 2263 Tic-Tac-Toe
- 2270 Decision-making
- 2280 Intellectual skills
  - 2281 Reading
  - 2282 Concept acquisition
  - 2283 Problem-solving
- 2300 Task skills
  - 2301 Keyboard operation
  - 2302 Metal surfaces, discriminating smoothness
  - 2303 Non-verbal sounds
  - 2304 Nursing, clinical methods
  - 2305 Task logic
  - 2306 Typing
  - 2307 Library maintenance
  - 2308 Electronic operation and maintenance
- 2320 Other specific applications of CAI
- 2330 Creativity
- 2400 Counseling
- 2500 Library retrieval
- 2700 Level of Application of CAI - General
- 2710 Retarded children
- 2720 Special education
- 2730 Elementary school
- 2740 Secondary school
- 2750 Vocational
- 2760 College
- 2770 Continuing
  - 2771 Inservice Teacher Education
- 2780 Industrial
- 2790 Military

3000-3999 CAI SYSTEMS

3000 Systems - General

- 3100 Systems analysis
- 3200 Common system characteristics
- 3210 Time-sharing
- 3220 Response processing
- 3400 I/O Equipment - General
- 3401 Display techniques
- 3410 Response techniques
- 3500 Central Processing Units
  - 3501 GE-235 and D-30
  - 3502 GE 245
  - 3510 IBM 1400 series
  - 3511 IBM 7094
  - 3512 IBM 1620
  - 3513 IBM 650
  - 3514 IBM 7090
  - 3515 IBM 360 series
  - 3516 IBM 1800, 1130
  - 3520 DEC PDP series
  - 3525 CDC 1604
  - 3530 ILLIAC
  - 3535 Bendix G-20
  - 3536 UMShN
  - 3537 Utal-1
  - 3538 Solomon
  - 3539 SDS 940
- 3600 Student Variables - General
  - 3610 Individual differences
  - 3620 Motivation
- 3700 Storage
- 3800 Systems
  - 3801 IBM/System 1500

ENTELEK CAI/CMI INFORMATION EXCHANGE

CAI THESAURUS

- 3860 RCA/Instructional 70
- 3861 RCA/Instructional 71
- 3870 Technomics 6700

- 3900 Training Subsystems
  - 3901 System 475L

4000-4999 PROGRAMMING LANGUAGES

- 4000 Languages - General
  - 4001 Natural language
  - 4010 Problem and calc. languages
    - 4011 BASIC
    - 4012 TEACH
    - 4013 SIMIN
    - 4014 APL
    - 4015 TELCOMP
    - 4016 ESI
    - 4017 CAL
    - 4018 FOCAL
  - 4100 Teacher languages (incl. text processing languages)
    - 4101 COURSEWRITER
    - 4102 MENTOR
    - 4103 CATO
    - 4104 COMPUTEST
    - 4105 PLANIT
    - 4106 ELIZA
    - 4107 ISL-1
  - 4200 Problem-oriented student languages
    - 4201 STRESS
    - 4202 COGO
    - 4203 SEPOL
  - 4300 Compilers
    - 4301 ALGOL
    - 4302 DIP
    - 4303 EDIT
    - 4304 FORTRAN
  - 4400 Interpreters
  - 4500 Assemblers
    - 4501 PDP-8
  - 4600 Utility programs
    - 4601 PDP-8

5000-5999 INSTRUCTIONAL THEORY

- 5000 General
  - 5100 Studies of learning
    - 5101 Paired-associates learning
    - 5110 Learning set
    - 5120 Inspection behavior
    - 5130 Problem-solving
    - 5135 Concept formation
    - 5140 Computer simulation of human learning and problem-solving
    - 5145 Artif. Intelligence
    - 5150 Pattern Recognition
    - 5160 Learning Models
    - 5165 Response Mode
    - 5170 Response Measurement
    - 5171 Response Latency
  - 5200 Instructional logics
    - 5201 Tutorial
    - 5202 Intrinsic
    - 5203 Adaptive
    - 5204 Socratic
    - 5205 Drill & Practice
    - 5206 Learner Controlled
  - 5300 Simulation
  - 5400 Game
  - 5500 Testing

6000-6999 PROGRAMMED INSTRUCTION

- 6000 General
  - 6100 Sequence variables
    - 6101 Subject-matter structure
  - 6200 Adaptivity (Individualizing) Decision Structure - General
    - 6210 Instructional Alternatives
    - 6220 Decision logic
  - 6300 Frame construction
  - 6400 Program Generation
  - 6500 Motivation

7000-7999 GENERATION & EVALUATION

- 7100 Methodology
- 7200 Results

8000-8999 ADMINISTRATION

- 8000 General
  - 8100 Conferences and workshops
  - 8200 Cost Analyses
  - 8300 Regulations
    - 8301 Copyright
    - 8302 Communication tariffs

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CMI THESAURUS

1000 General

- 1100 Educational Goals
- 1200 Bibliographies
- 1300 Literature Reviews or Surveys
- 1400 General Periodicals

2000 CMI System Design

- 2100 General System Design and/or Theory
- 2200 CMI Environment
- 2210 Physical Plant
- 2220 Management Information System
- 2230 Staff
  - 2231 Requirements
  - 2232 Organization
  - 2233 Training and Development
- 2300 Hardware
  - 2310 CPU
  - 2320 Terminals
  - 2330 Storage
- 2400 Software
- 2410 Compilers
  - 2411 COBOL
- 2500 System Evaluation and Optimization
- 2600 Prescription Generation
- 2700 Results

3000 Subject Matter (Use Dewey headings)

4000 Educational Objectives

- 4100 Behavioral Objectives

5000 Instructional Alternatives

- 5100 Content
- 5200 Sequence
- 5300 Media and Learning Materials
- 5400 Grouping

6000 Testing

- 6100 Entry and Prior
  - 6110 Aptitude
  - 6120 Achievement
  - 6130 I.Q.
- 6200 Internal Testing
  - 6210 Pre-tests
  - 6220 Post-tests
  - 6230 Curriculum-embedded Tests

7000 Decision-Making

- 7100 Among Instructional Alternatives
- 7200 Among Career Alternatives
  - 7210 Guidance, counseling

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Laboratory
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Computer-Assisted Instruction Lab.
University of Texas
Austin, Texas 78712

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Washington University
Lindell & Skinker Boulevards
St. Louis, Missouri 63130

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Learning Research & Development
Center
University of Pittsburgh
Pittsburgh, Pennsylvania 15313

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Instruction
Florida State University
Tallahassee, Florida 32306

1 Dr. Albert E. Hickey
Entelek, Incorporated
42 Pleasant Street
Newburyport, Massachusetts 01950

1 Dr. Robert R. Mackie
Human Factors Research, Inc.
6780 Cortona Drive
Santa Barbara Research Park
Goleta, California 93107

1 Dr. Joseph W. Rigney
Electronics Personnel Research Group
University of Southern California
University Park
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1 Dr. Lawrence M. Stolurow
Harvard Computing Center
6 Appian Way
Cambridge, Massachusetts 02139

1 Dr. Joseph A. Van Campen
Institute ofr Math Studies in the
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Stanford University
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Interdisciplinary Communications
Program
Smithsonian Institution
1025 Fifteenth Street. N.W.
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Washington D.C. 20005

1 Dr. John C. Flanagan
American Institutes for Research
P.O. Box 1113
Palo Alto, California 94302

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Department of Education
Institute of Instructional System
Technology & Research
Chapman College
Orange, California 92666

1 Dr. Howard H. Kendler
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Center for Educational Technology
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4001 Harewood Road, N.E.
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404 East Lancaster Avenue
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1 Dr. John Annett
Department of Psychology
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1 Dr. Lee J. Cronbach
School of Education
Stanford University
Stanford, C lifornia 94305

1 Dr. M. C. Havron
Human Sciences Research, Inc.
Westgate Industrial Park
7710 Old Springhouse Road
McLean, Virginia 22101

1 Dr. Carl E. Helm
Department of Educational Psychology
Graduate Center
City University of New York
33 West 42nd Street
New York, New York 10036

1 S. Fisher, Research Associates
Computer Facility
Graduate Center
City University of New York
33 West 42nd Street
New York, New York 10036